

equatorial belt was divided into two parts by a longitudinal belt practically encircling the planet.

On March 30, at 5h. 55m. (standard mountain time), the shadow of satellite I. was seen to be nearly twice as broad as it was high, and at 6h. 13m. a penumbra to it was observed. Markings were seen on satellite III. on April 2.

THE UPPER LAYERS OF THE SOLAR ATMOSPHERE.—In a paper published in No. 16 (April 19) of the *Comptes rendus* M. Deslandres describes some results obtained with his new spectroheliograph. Photographs obtained previously showed long dark streaks of calcium vapours when the secondary slit was set on the centre of the "K" line; these streaks were named "filaments."

By employing a larger dispersion and an additional slit of an improved form, M. Deslandres succeeded in isolating entirely the K_β line, and found that these filaments were shown much more definitely than on the earlier negatives, when the light employed was a mixture of the K_β and K_γ lines. A similar result follows if the $H\alpha$ line of hydrogen be employed. These dark filaments, then, are the characteristic feature of the sun's upper atmosphere, and differ from Hale's "dark flocculi" in that they are black on both the K_β and $H\alpha$ (centre of line) photographs.

In the same number of the *Comptes rendus* Prof. Hale makes some remarks relative to Deslandres's paper, and states that on employing the large spectroscope he found that the relative intensity of the bright and dark flocculi depends upon the part of the line ($H\alpha$) employed. With the slit set on the central part of the line the bright flocculi are very intense, but if the light from the edge of the line is exclusively used, the dark flocculi are shown strongly, whilst the bright flocculi are faint or even invisible.

SPECTRA OF SOME SPIRAL NEBULÆ AND GLOBULAR STAR CLUSTERS.—With a specially designed spectrograph attached to the Crossley reflector, Mr. E. A. Fath has succeeded in photographing the spectra of a number of spiral nebulae and globular clusters, the investigation having been undertaken in order to test the statement that the spectra of the former are continuous. The collimator of the spectrograph has an aperture of 54 mm. and a focal length of 315 mm., and the prism is of light flint glass and 30° angle, whilst the camera objective is composed of two plano-convex lenses of 51 mm. aperture and 155 mm. equivalent focal length. The scale of the spectrum is such that the distance from λ 3727 to λ 5007 on the plate is approximately 3.3 mm.; exposures varying from 3h. 19m. to 18h. 11m.—for the Andromeda nebula—were found necessary.

There is not space here to reproduce the detailed discussion given in Lick Observatory Bulletin No. 149, but the general conclusions are of great interest. No spiral nebula investigated has a truly continuous spectrum, although this is the fundamental feature of all their spectra, which range from those having principally bright lines to those containing only absorption lines of the solar type. The great nebula in Andromeda comes in the latter category, and fourteen absorption lines were measured.

The spectra of the spiral nebulae are best interpreted by the hypothesis that these bodies are unresolved star clusters with varying conditions of gaseous envelopes. Thus, if the Andromeda nebula were such a cluster in which stars of the solar type preponderated, its spectrum would be sufficiently explained. The exposures on globular clusters showed that clusters in which one spectral type of star predominates do exist. But this question needs a great deal more investigation before the theory can be accepted, and, as Mr. Fath points out, Bohlin's parallax for the Andromeda nebula, 0.17", would require that, if this object is an unresolved star cluster, the size of the components is, with reasonable assumptions, of the order of that of the asteroids. The difficulty of the investigation lies in the extreme faintness of the objects to be observed. While two minutes' exposure on Arcturus, with the Mills spectrograph attached to the 36-inch refractor, gives a measurable spectrum, it would require about 500 hours to give a satisfactory spectrum of the Andromeda nebula, one of the brightest of the spiral nebulae.

NO. 2064, VOL. 80]

THE INTERNATIONAL COMMISSION FOR SCIENTIFIC AERONAUTICS.

THE sixth Congress of the International Commission for Scientific Aeronautics commenced at Monaco on April 1. Thirty-three members were present, representing fourteen countries. The Prince of Monaco, by whose invitation the meeting was held at Monaco, placed the rooms of the new Oceanographical Museum at the service of the commission. Among the members present were Prof. Hergesell (the president), Profs. Assmann, Berson, and Captain Hildebrandt from Germany, M. Teisserenc de Bort from France, Prof. Hildebrandsson from Sweden, Prof. A. L. Rotch from the United States, Generals Rykatcheff and Kowanko from Russia, Colonel Vives y Vich from Spain, Prof. Bjerknes from Norway, Prof. Palazzo and Dr. Oddone from Italy, Hofrat von Konkoly from Hungary, M. Vincent from Belgium, Captain Ryder from Denmark, and Messrs. P. Alexander and C. J. P. Cave from this country.

Prof. Hergesell, in opening the congress, spoke of the extent of the observations now made by members of the commission, and of the work that had been done since the last meeting at Milan. He mentioned particularly the series of ascents made in July, 1907, the full results of which had just been published, and which included a network of observations extending over a great part of the northern hemisphere. The instruments used were very satisfactory, but Prof. Hergesell warned observers to make frequent calibrations to ensure accuracy in the observations. He also mentioned the important work on wind direction and velocity by means of theodolite observations on *ballons sondes* and pilot balloons.

The Prince of Monaco, in welcoming the congress, spoke of the work that had been done by Prof. Hergesell and himself on his yacht the *Princesse Alice*, and of the finding of *ballons sondes* at sea. By means of observations to determine the trajectory, Prof. Hergesell was able to determine the point of fall with such accuracy that balloons are now found at sea more easily than on land.

At the morning meeting on April 2 Prof. Assmann read a paper on rubber balloons, and spoke of the improvement that had lately been made in their manufacture; it had been found possible to eliminate small foreign particles in the rubber, which consequently could be stretched far more before bursting occurred. M. Teisserenc de Bort spoke of goldbeater's skin for captive balloons, and mentioned that, by a system of elastic lacing, expansion could be secured during the ascent and "pocketing" avoided during the descent. Prof. Hergesell spoke of the rapid deterioration of rubber balloons owing to the effect of light, especially in the tropics; to guard against this Prof. Assmann uses a yellow covering for captive rubber balloons.

Prof. Assmann then read a paper on a method of ventilating the instrument for a short time during an ascent, when, owing to decrease of vertical velocity, insolation might cause too high a temperature to be recorded; the apparatus consists of a polished metal sphere containing compressed air, which can be opened by an electric contact actuated by the barometer at any desired height. He spoke of the doubts that had been expressed, particularly in England, on the reality of the isothermal layer, or "stratosphere" as it has been named by M. Teisserenc de Bort, and hopes that his apparatus may definitely set these doubts at rest. Mr. Cave said that no one in England who is working at the study of the upper air has any doubts as to the reality of the stratosphere; Prof. Hergesell cited cases of rapid descents of instruments, and M. Teisserenc de Bort mentioned night ascents as proving the real existence of the phenomenon. Prof. Hergesell noticed that no member present doubted the fact, and asked the secretaries particularly to note this agreement of opinion.

Prof. Hergesell showed a new meteorograph for use with manned and captive balloons. Prof. Palazzo an apparatus for detaching balloons, and similar instruments were shown by Prof. Hergesell and General Rykatcheff. M. Teisserenc de Bort deprecated the idea of limiting the ascent of a *ballon sonde*.

Prof. Rotch urged that all kite ascents should be tabulated on a uniform plan, and that temperatures on the ground-level should be given at intervals during the flight; he also spoke of the confusion that existed with regard to the sign of the temperature gradient.

Prof. Hergesell announced that a communication had been received by Prof. Köppen, who was unable to attend the congress; he proposed that all measurements of atmospheric pressure should in future be given in absolute C.G.S. units.

At the afternoon meeting on April 2 Prof. Bjerknes read a paper on the theoretical applications of upper-air observations, and spoke of the necessity for further co-operation. He advocated a series of strictly simultaneous ascents at all the stations, and suggested that on certain days observations should be made at 7 a.m., 1 p.m., and 7 p.m. Greenwich mean time. At 1 p.m. ascents of *ballons sondes* and kites should be made, and at the other hours, besides the ordinary barometer and thermometer readings at the ground-level, there should be as many observations of pilot balloons as possible; if possible, *ballons sondes* might be sent up at the other hours, but the mid-day ascent should be the principal one. He also strongly supported Prof. Köppen's proposition, and said that the use of dynamical units for atmospheric pressure would greatly facilitate theoretical work. M. Teisserenc de Bort said that he saw no difficulty in changing the units if there were any real advantage to be gained by the change. Mr. Cave said that the practice had already been introduced in England in the official publication of the upper-air observations in the Weekly Weather Report, and that Dr. Shaw was strongly in favour of the change being generally made.¹ Prof. Bjerknes said that he would publish tables to enable observers to change the old units into the new ones. In regard to the series of simultaneous observations advocated by Prof. Bjerknes, M. Teisserenc de Bort proposed that one of the smaller series of ascents should be set apart to be made on Prof. Bjerknes's plan, and General Rykatcheff suggested that the time of the ascents should remain as at present, but that they should be made strictly simultaneously, and that additional pilot balloon ascents should be made.

M. de Massani then read a paper on the proposed upper-air observations in Hungary, and Mr. Alexander one on the instruction in aerodynamics in the United Services College, Windsor.

M. Teisserenc de Bort read a paper on the results of theodolite observations on *ballons sondes* at Trappes, and the importance of this method in the verification of heights as determined by the barometer. As a result of his observations, he finds that the cyclonic circulation of the air in low-pressure systems does not extend to great heights in the atmosphere, but that the balloon sooner or later gets into a general wind current, mostly from west to south-west in these latitudes; over high-pressure areas the wind is light, and great irregularities in direction are found; there are often several entirely different currents superposed one above the other; this condition had also been observed in the tropics. With regard to the wind in the stratosphere, M. Teisserenc de Bort has often found a small change in direction at its lower limit, but the changes are neither so regular nor so great as might have been expected. In the discussion that followed Prof. Hildebrandsson said that the observations of M. Teisserenc de Bort in low-pressure areas confirmed his own observations of clouds; it was clear that at 3000 metres or so the isobars over a low-pressure area were no longer closed on the polar side. Mr. Cave said that his observations showed only a small change of direction when a balloon entered the stratosphere, but there had generally been a considerable decrease of velocity; his observations had been made at times when the wind velocities in the lower layers were considerably higher than in most of the cases mentioned by M. Teisserenc de Bort. Prof. Hergesell said that he had not found any regular change of wind direction in the upper layer, but he had in general found a diminution of velocity; but this diminution often occurred at some distance above the lower limit of the stratosphere.

Prof. Hergesell gave an account of the experiments he

had made to determine the rate of ascent of rubber balloons in still air. From these experiments he has deduced a formula from which, within certain limits, the rate of ascent of a balloon may be calculated from its weight and from its free lift when inflated with hydrogen. Both he and M. Teisserenc de Bort consider that the vertical velocity is constant up to moderate heights; the theoretical increase of velocity due to decreased density of the air is probably more or less balanced by loss of gas from the balloon. If we know the rate of ascent, and determine the heights trigonometrically, we are able to measure vertical currents in the atmosphere. From his own observations Prof. Hergesell concludes that there is almost always some vertical motion, and sometimes he has observed a vertical current downward of as much as 1 metre per second, or even more; but in general a downward movement at one time is more or less counterbalanced by an upward movement at another, and therefore the one theodolite method, when the height of the balloon is taken as a function of the time, gives the wind velocities with very fair accuracy. Some discussion ensued about the theodolites used for the observations, and it was agreed that for accurate work with a base line the theodolites should read to five minutes of arc, but for the one theodolite method less accuracy was needed. A triangular base with three observers was also strongly recommended.

M. Teisserenc de Bort read a paper on the theory of the isothermal layer, which formed the subject of Mr. Gold's recent theoretical investigations (Proceedings of the Royal Society, vol. lxxxii., 1909). Prof. Hergesell said that he had not seen the original paper, but he thought from the account that M. Teisserenc de Bort had given that the theory had much to recommend it. M. Teisserenc de Bort said he thought the adiabatic distribution of temperature in the lower layers was due entirely to the vertical circulation of air in this part of the atmosphere.

On the afternoon of April 5 the Prince of Monaco was present, and Prof. Berson gave an account (which has appeared in NATURE, April 8, p. 171) of his observations on the Victoria Nyanza and off the east coast of Africa. Prof. Palazzo gave an account, illustrated by numerous lantern-slides, of his expedition to Zanzibar and its neighbourhood.

At the meeting on Tuesday morning Prof. Hergesell said that he had received a gift from the Kaiser to the commission in the shape of two portable houses, which could be used as a temporary observatory at any place where an extended series of observations might be useful; it had been proposed to erect them for a year or two on the Peak of Teneriffe, but the Spanish Government had now decided to establish a permanent observatory there. Colonel Vives y Vich gave an account of what it is proposed to do, and said that kite and pilot-balloon ascents would be made; to hasten on the commencement of the meteorological work, the Spanish Government would be willing to accept the temporary loan of the houses under certain conditions until the permanent buildings are ready. It was resolved to send a telegram to the Kaiser thanking him for his gift to the commission and for the interest he had taken in the work, and one to the Spanish Government accepting the conditions as to the houses.

Dr. Assmann spoke of the importance of the study of the upper air for aerial navigation, and thought that the cooperation of aéro clubs and others interested might be obtained, and that by this means a wider study of the subject might be possible. He looked forward to the establishment of more observatories where daily ascents should be made as at Lindenberg, and hoped that in time it might be possible to publish daily synoptic charts giving the isobars at different heights above the surface.

At the last meeting, in the afternoon of April 6, the following resolutions were carried:—

(1) Prof. Köppen's proposal to adopt absolute measures for atmospheric pressure was referred to the International Meteorological Committee.

(2) The July series of observations to be made at 7 a.m. Greenwich mean time, and pilot balloons to be sent up three times a day in accordance with the proposals of Prof. Bjerknes.

(3) M. Vincent's proposal that frequent observations of

¹ See introduction to the Weekly Weather Report, 1909.

the state of the sky should be made on international days was recommended.

(4) The importance of observatories for the study of the upper air to be urged on all countries which do not possess them.

(5) M. de Massani's project to establish an upper-air observatory on the plains of Hungary, near Kecskemét, was endorsed.

(6) It was resolved to bring to the notice of aéro clubs the importance of observations during ascents of manned balloons for sport, &c.

(7) Copies of traces of registering instruments are to be exchanged between members of the commission if required.

(8) Titles of new publications to be sent to Prof. Assmann for publication and analysis in *Fortschritte der Physik*, or to the U.S. Weather Bureau for the *Monthly Weather Review*.

(9) Prof. Rotch's proposition to express the temperature gradient as positive when the temperature decreases with altitude was adopted.

(10) Prof. Rotch's proposal that in the published observations of kite ascents simultaneous observations at ground-level be given was adopted.

(11) The thanks of the commission to be sent to the Austrian Minister of War and to the Vienna Aéro Club for their assistance, and to other Governments which have encouraged the study of the upper air.

(12) The thanks of the commission to be sent to the Spanish Government for its promise to establish an observatory on the Peak of Teneriffe, and to the Spanish military aeronauts and to the German Government for aiding the project.

(13) Various new members were elected—MM. Trabert, Vincent, Kleinschmidt, Bjerknes, Ryder, and Bamler; the directors of the observatories of Irkutsk, Tiflis, and Ekaterinburg; and several military aeronauts, including Colonel Capper.

(14) It was resolved that the next meeting of the commission should be held in Vienna in the autumn of 1912.

Besides the formal meetings of the congress, the members were entertained on several occasions by the Prince of Monaco. A lecture was given by M. Bourée on the oceanographical work that has been done by the Prince on his yacht the *Princesse Alice*, and on April 4 the members were taken by motor to the Nice Observatory by the Corniche Road.

PROBLEMS OF APICULTURE.

ABOUT four years ago a mysterious disease appeared among the bees of the Isle of Wight, and caused great mortality. The most characteristic features were disinclination to work, some distension of the abdomen, frequent dislocation of the wings, and, later, inability to fly. At this stage the bees could only fly a few feet from the hive, and then dropped and crawled about aimlessly on the ground. They could often be seen crawling up grass stems or up the supports of the hive, where they remained until they fell back to the earth from sheer weakness, and soon afterwards died. An investigation was begun by Mr. A. D. Imms, but, as he was unable to continue the work, the Board of Agriculture secured the services of Dr. W. Malden, whose report is issued in the February number of the *Journal of the Board of Agriculture*. He finds that the only organ affected is the chyle stomach, all other organs being normal; there is no paralysis of the wing muscles. The disease is almost certainly infectious, and a plague-like bacillus was frequently found in the chyle stomachs of diseased bees, but not in those of healthy bees. Owing to difficulties of manipulation, it was impossible to establish definitely any causal connection between the disease and the presence of the organism, although the experiments strongly suggest that there is such a connection. It is to be hoped that the investigation may be completed; it promises to be of general importance for the solution of problems connected with infectious diseases of bees.

The whole question of bee diseases needs working out more fully, for little is as yet known with any degree of

certainly about the causes of some of them, and few of the disease-producing bacteria have been investigated. An important administrative question is also raised: if a diseased hive is not at once destroyed it becomes a source of infection for surrounding hives, and one careless bee-keeper can in this way do serious harm to others round about him without becoming liable to compensate them for their loss. In a recent Bulletin issued from the United States Department of Agriculture Bureau of Entomology (No. 75), discussing the status of apiculture in the United States, it is urged that bee-keeping should not be popularised, but should be confined, so far as possible, to competent men having a sufficient financial stake in the business to ensure that the bees should have proper attention. "No question in apiculture," says the writer, "at all compares in importance with the control of bee diseases." Two contagious brood diseases already cause serious loss, and there is reason to believe that they are spreading at a rapid rate. The bee industry of the States is quite important enough to deserve consideration; the value of the honey is put at 20,000,000 dollars annually, but the work of the bees in fertilising the blossoms of fruit trees is valued at a still higher figure.

Among other bee problems that are still obscure, few are more interesting than the mating of bees. A host of questions suggest themselves as one watches the wonderful flight of the virgin queens and the drones, but investigation is rendered difficult by the absence of methods. It is no easy matter to arrange that only selected drones shall mate with the queens. Only few cases are on record where mating took place when the bees were caged, even though all the conditions were normal and the cages used were very large—Mr. Davitte's was 30 feet high and of the same diameter. Mr. Miller recently made some experiments, with negative results, at the Rhode Island Agricultural Experiment Station on this subject, and his paper, in the current annual report, affords a good illustration of the difficulties that the investigator meets.

METEOROLOGY OF THE DUTCH EAST INDIES.

WE are indebted to the Royal Observatory of Batavia for the following valuable publications:—(1) meteorological, magnetical, and seismometric observations for 1906, and (2) rainfall observations made at the Netherlands East Indian stations for 1907. It may not be generally known that the establishment of this important observatory was primarily due to a suggestion made by Baron A. v. Humboldt to the Governor-General of Netherlands' India in 1856 (Bayard, Presidential Address to the Royal Meteorological Society, January, 1899). Humboldt pointed out the great value that a magnetical and meteorological observatory at Batavia would be for the promotion of knowledge concerning those phenomena between the tropics. The Amsterdam Academy strongly supported the suggestion, and invited Prof. Buys Ballot to draw up a plan. The proposal of the latter, in 1857, included the organisation of hourly observations at Batavia and the establishment of secondary stations at some places in the East Indian Archipelago, and Dr. P. A. Bergsma was subsequently appointed director of the proposed system. Hourly observations were commenced at Batavia in 1866, and have been continued without interruption down to the present time, with summaries after each five-yearly period, but the establishment of second-order stations was not carried out on account of expense. Wind observations are, however, made at many places by non-official observers, and are collected by the observatory. In 1879 Dr. Bergsma organised a system of rainfall observations throughout the archipelago which has since been regularly continued.

The data for 1907 are published in two volumes, giving (1) daily and monthly amounts, and (2) monthly and yearly amounts and the number of rain-days, together with the results for 1879–1907, at all stations having observations for five years and upwards. At the end of the year the official stations numbered 292, and included Java, Sumatra, Borneo, North Guinea, and the many islands lying between them, some of the principal places being provided